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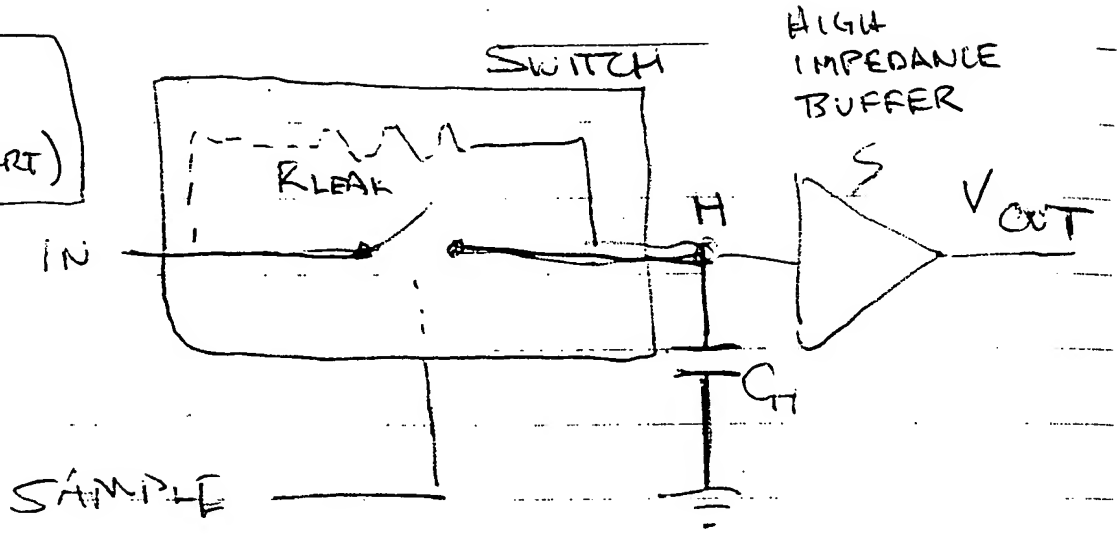
FIG. 1
(PRIOR ART)



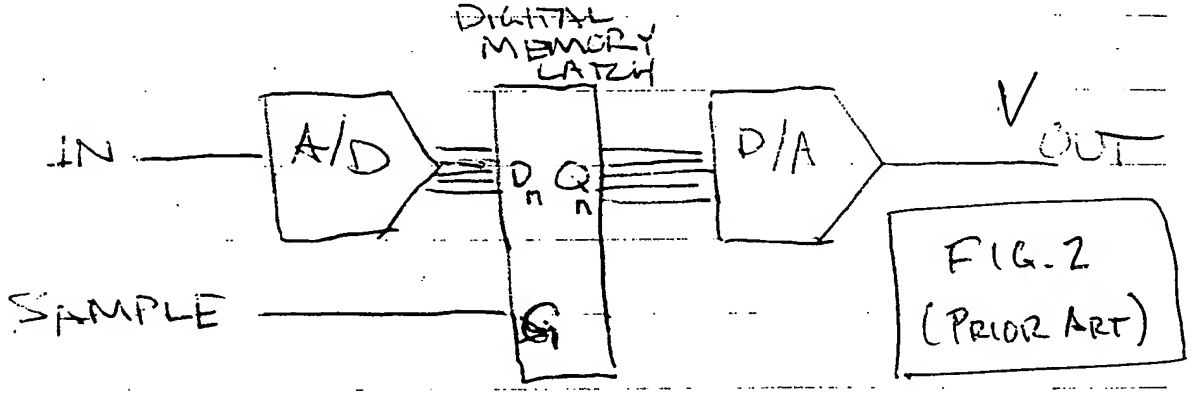
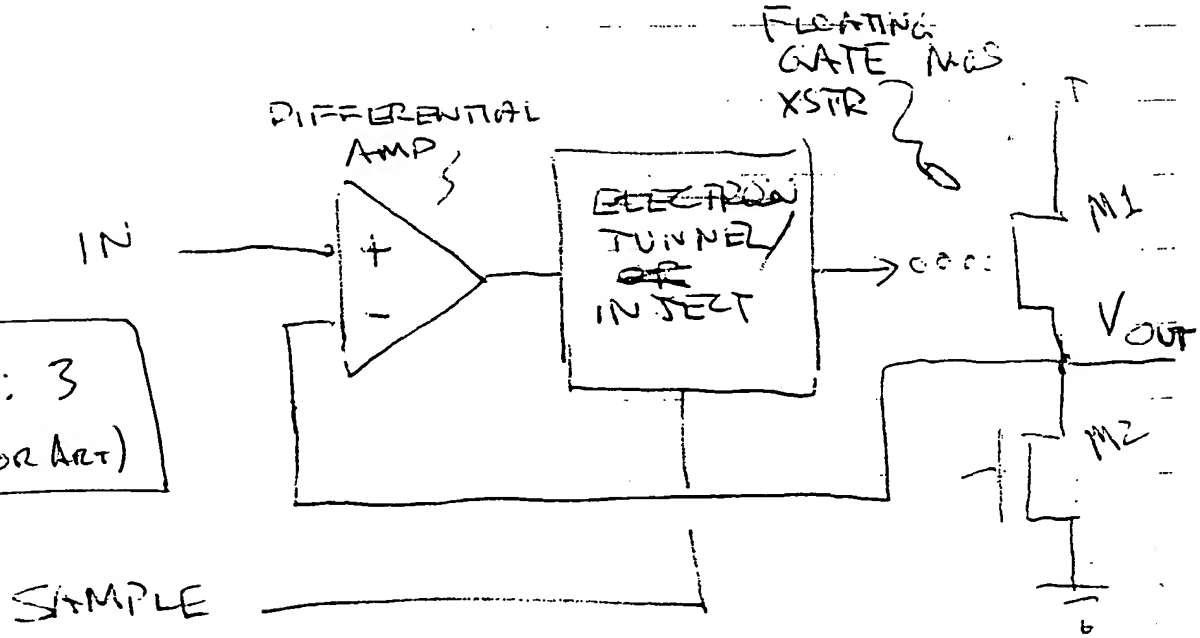


FIG. 2
(PRIOR ART)

FIG. 3
(PRIOR ART)



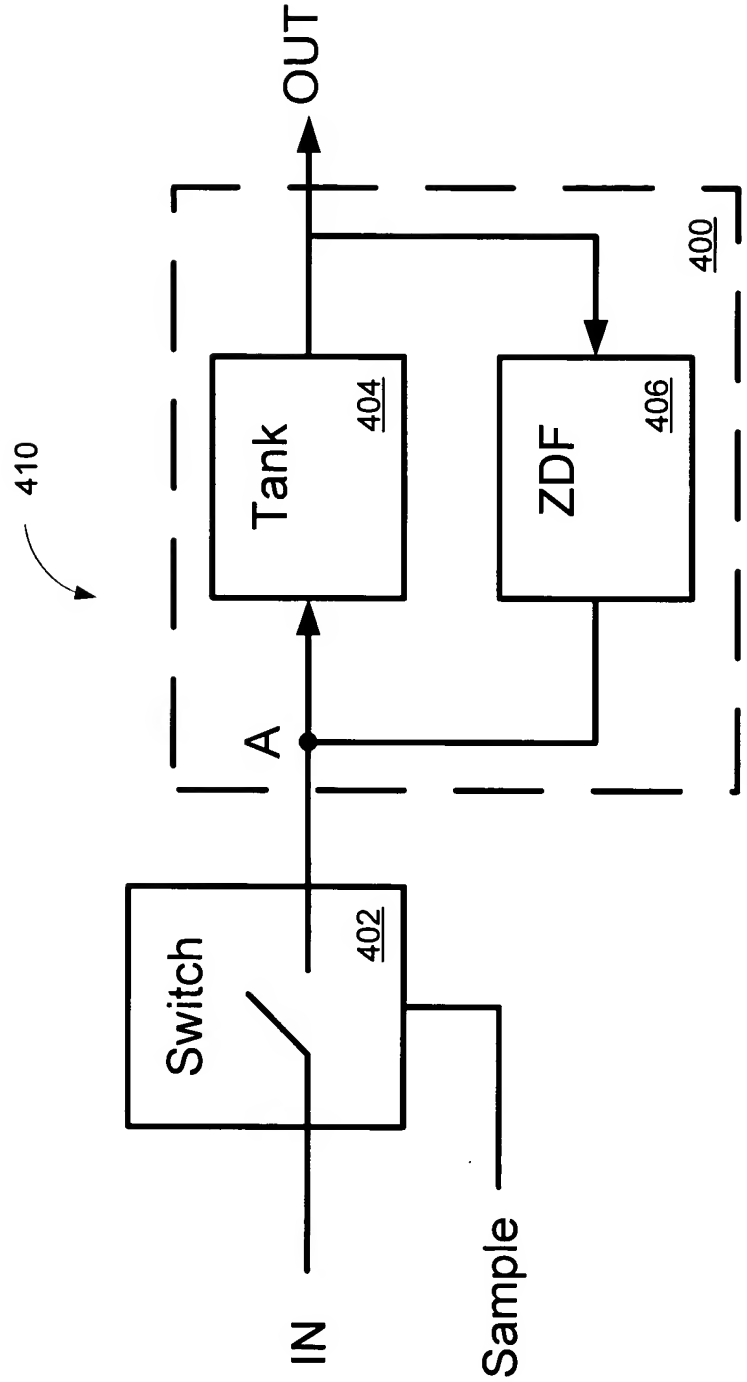
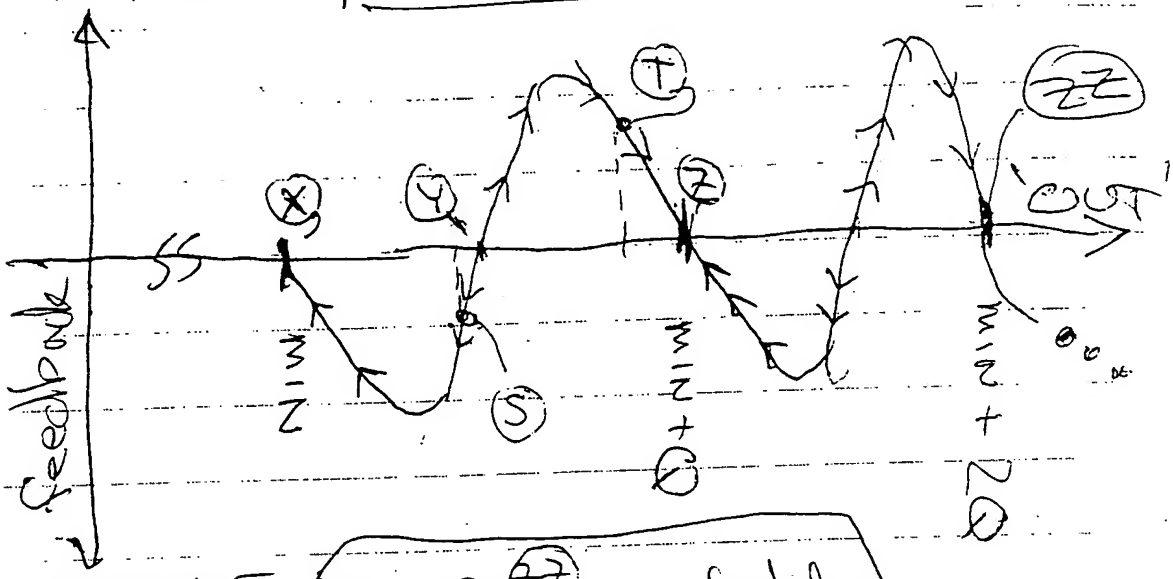


FIG. 4

DETAILS OF 'ZDF' TRANSFER FUNCTION

FIG. 5



(X), (Z), (ZZ) are stable

IF OUT IN RANGE (MIN, MIN+Q) THEN FEEDBACK FORCES TO EITHER (X), ie 'MIN' OR (Z) ie 'MIN+Q' AS SHOWN BY ARROWS.

NOTE: PER CONTROL SYSTEM THEORY, DYNAMICS OF TANK AND ZDF MUST BE SELECTED TO ACHIEVE LOOP STABILITY

SLOPE @ POINT (Y) PREFERABLY STEEP TO MOVE QUICKLY AWAY FROM (Y)

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ALTERNATIVES: WITH ~~MUX & BUFFER~~

MULTIPLEXOR SWITCH AND BUFFER

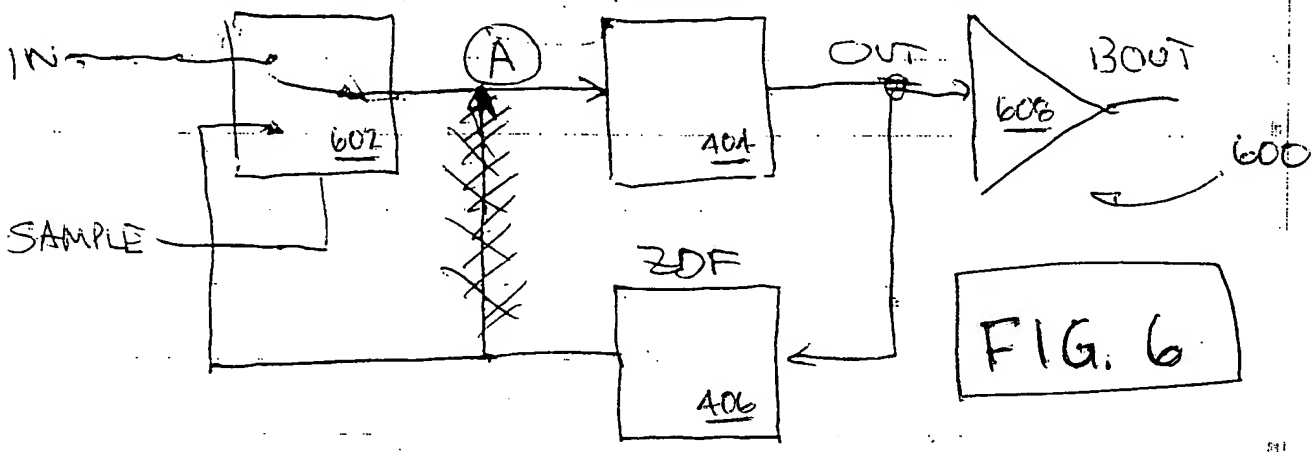

FIG. 6

USE OF MULTIPLEXOR TO ENSURE THAT

(A) ∈ 'IN' WHEN 'SAMPLE' AND

(A) ∈ 'ZDF ~~FEEDBACK~~' WHEN NOT 'SAMPLE'

ALTR USE OF BUFFER ON OUTPUT TO ENSURE OUTPUT LOAD DOESN'T EFFECT TANK 'OUT'.

EMBODIMENT DETAIL OF ZDF

~~CONTROLLED~~ OSCILLATOR

See next pg

2 APRIL 2003 (C)

DETAIL OF ZDF IN ONE EMBODIM.

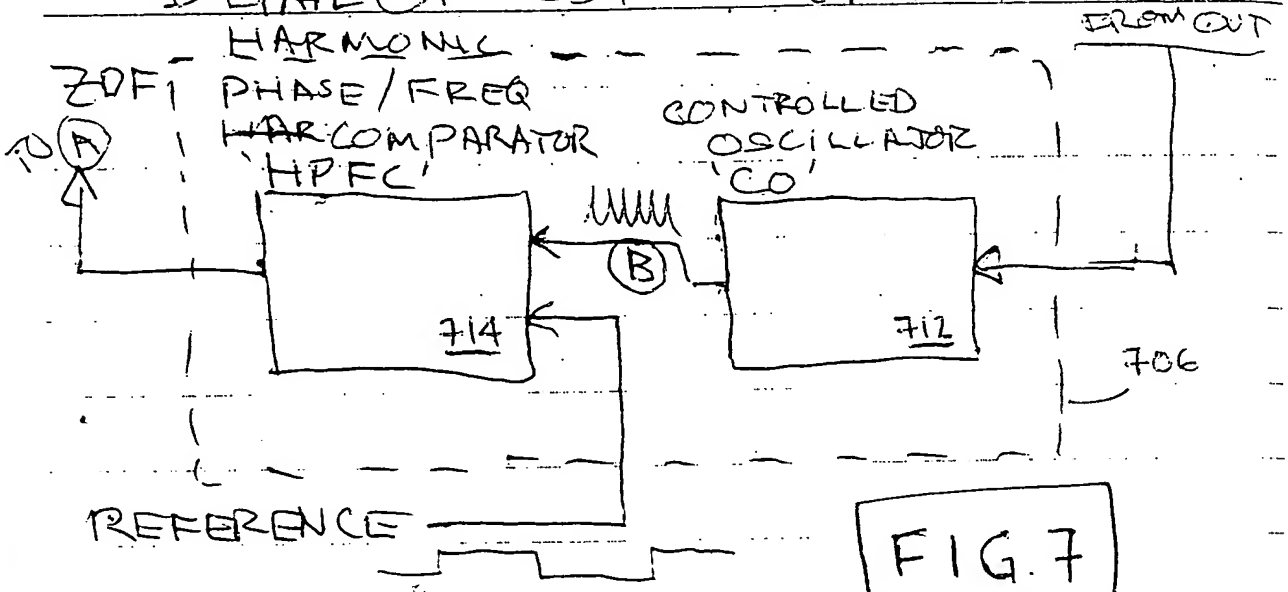

FIG. 7

'CO' AND 'HPFC' WELL KNOWN FROM PHASE LOCK LOOPS. 'HPFC' HAS OUTPUT THAT IS FUNCTION OF COMPARISON BETWEEN FREQUENCY/PHASE OF (B) AND ~~NOT~~ MULTIPLES OF FREQUENCY ON REFERENCE. THE QUANTIZATION, Q, IS THE 'CO' FREQUENCY RANGE ~~TYPICAL~~ DIVIDED BY THE ~~REFERENCE~~ FREQUENCY.

TYPICAL EG

Q => 100 : 1 RESOLUTION

'CO' FREQ. MIN = 1000 KHZ
MAX = 1400 KHZ

REFERENCE FREQ. = 4KHZZ

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'CO' FUNCTION

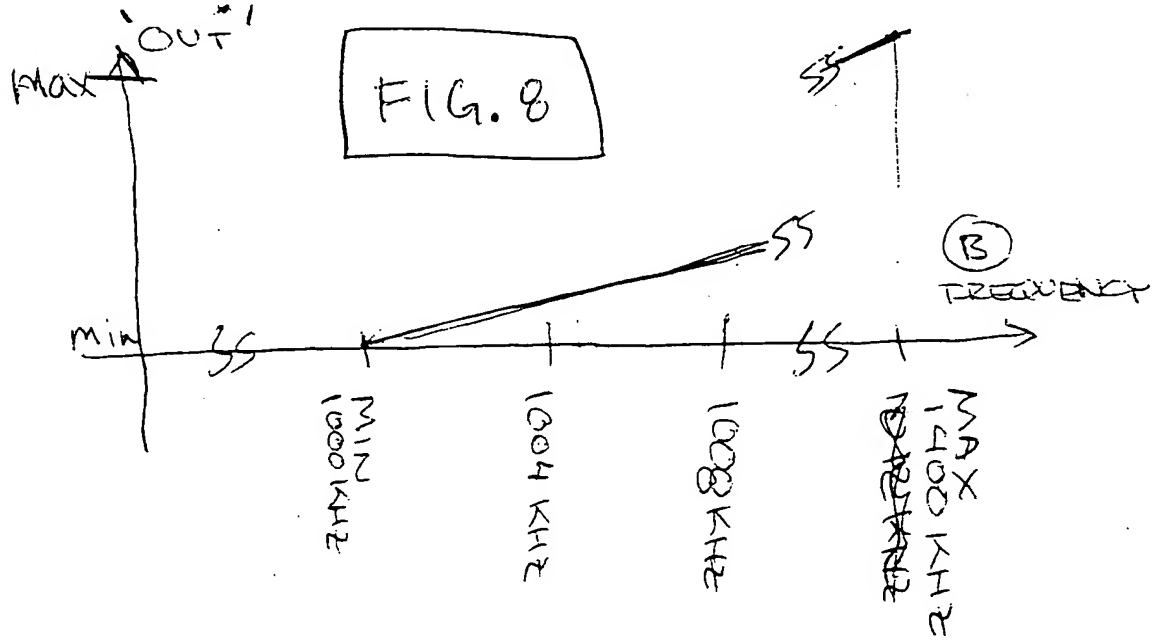
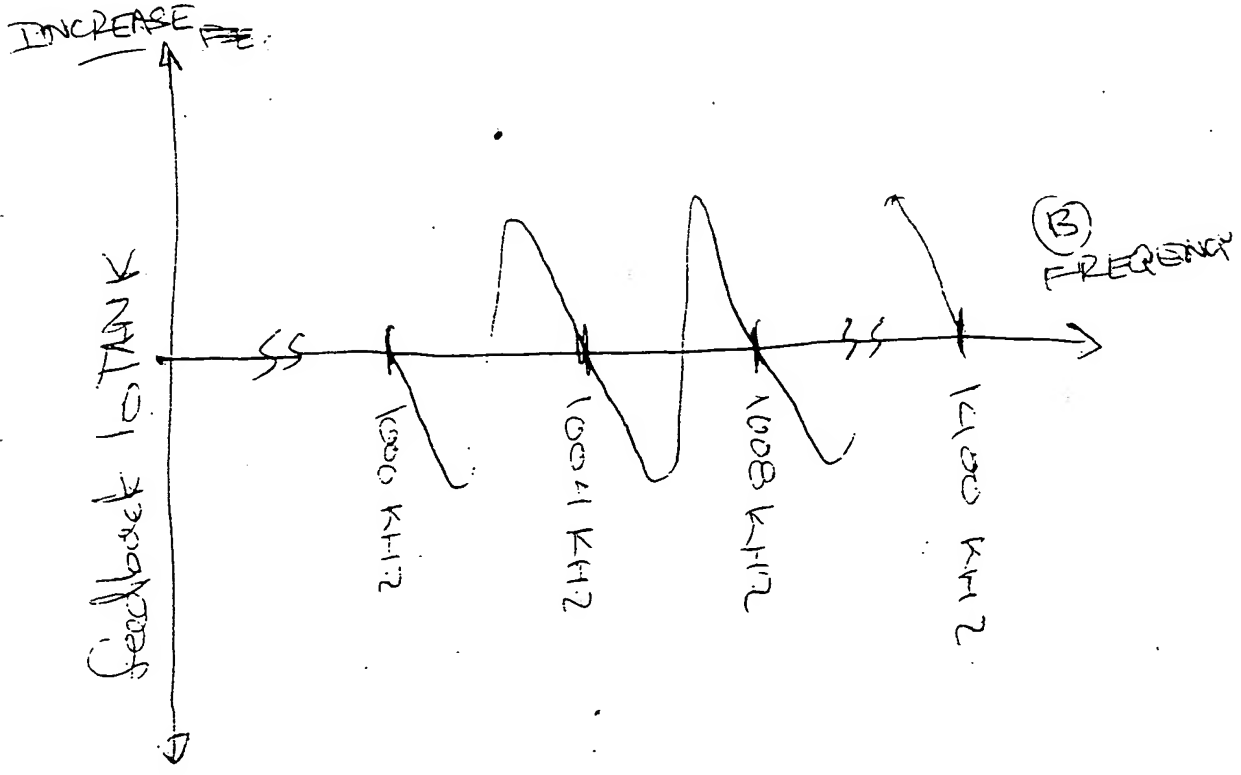


FIG. 8

'HPFC' FUNCTION



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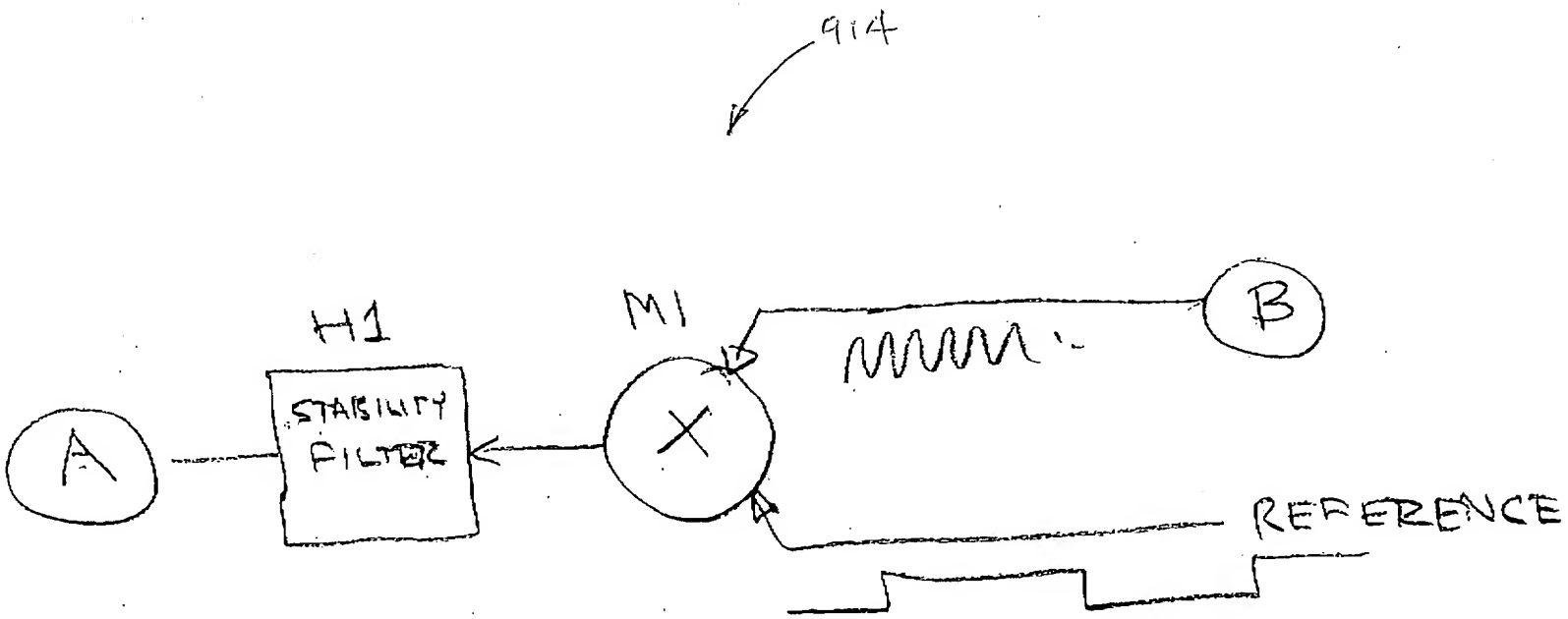


FIG. 9

HPFC

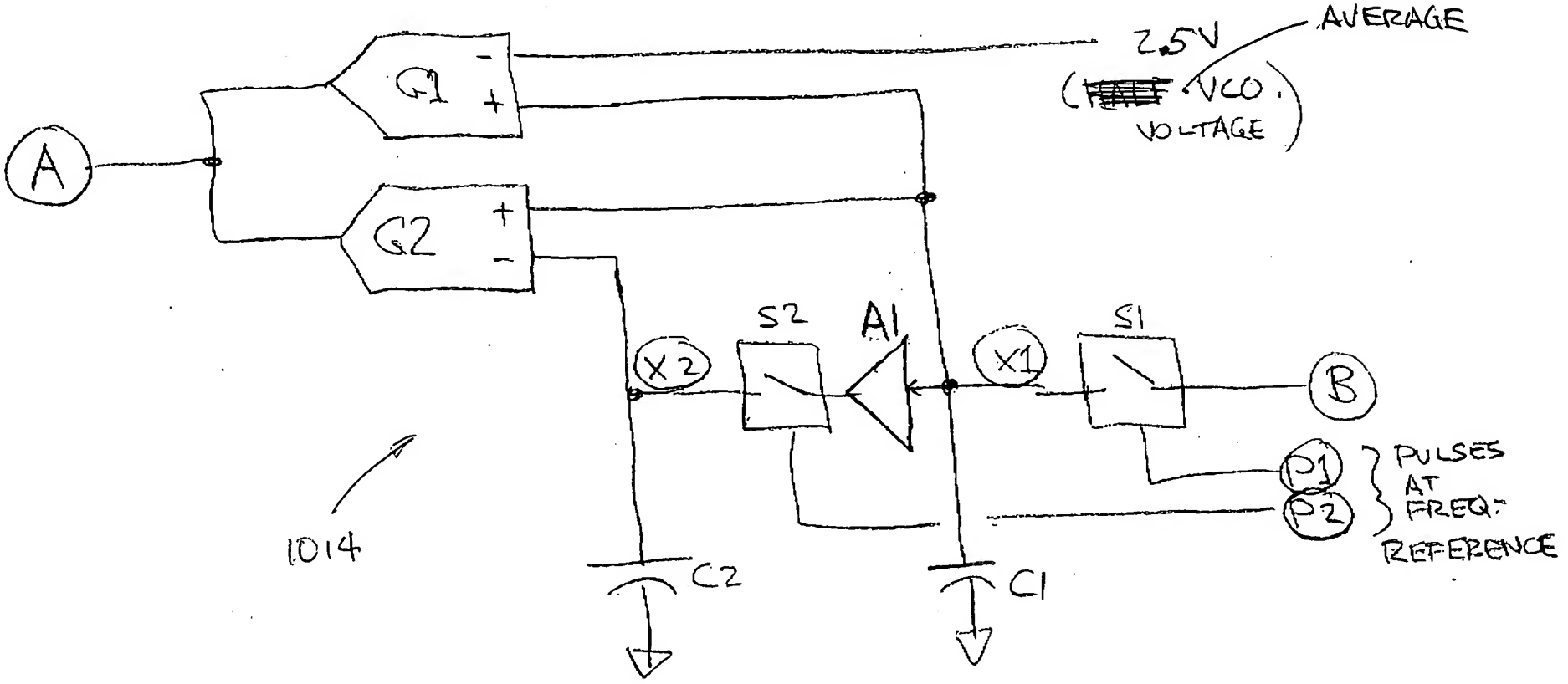
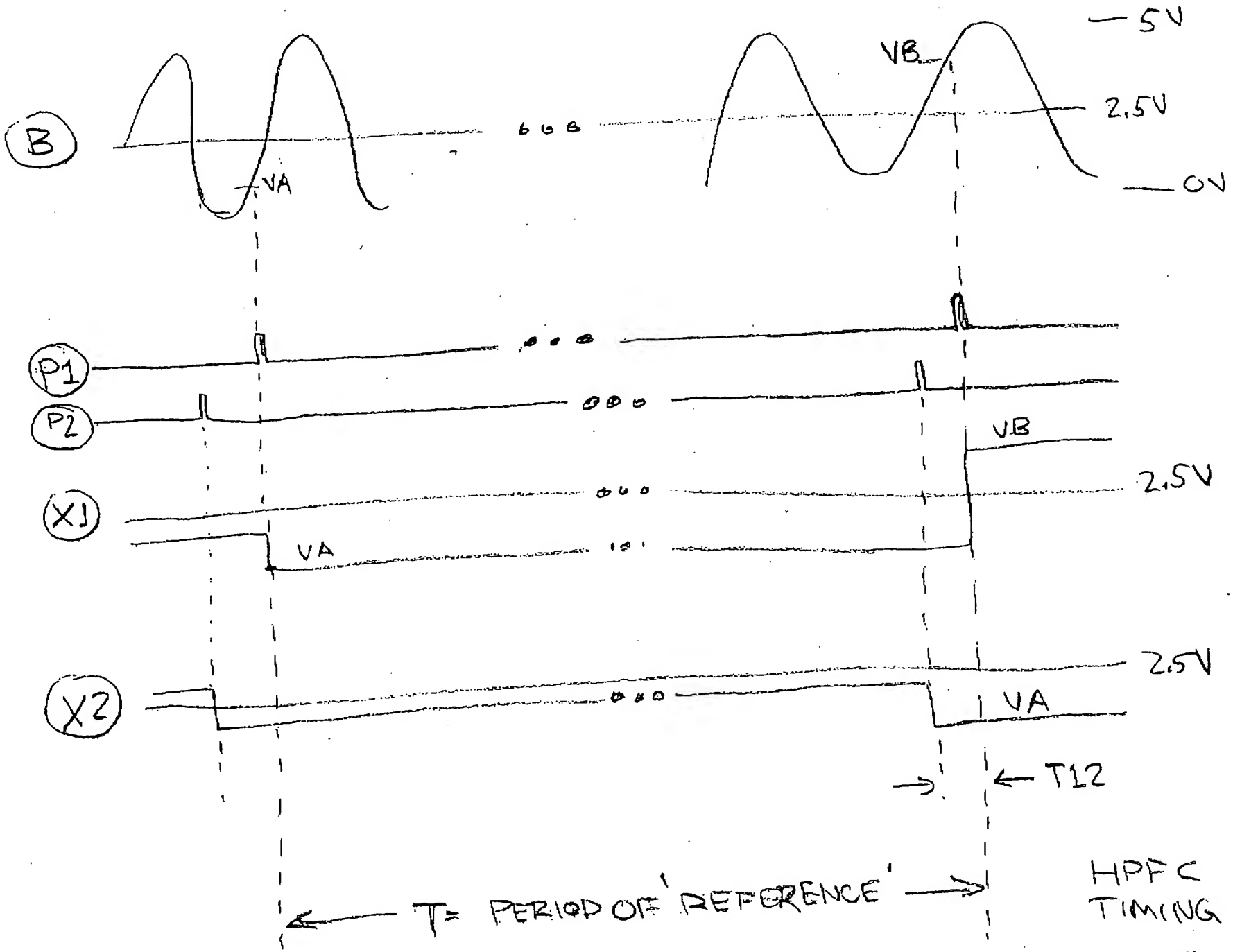


FIG. 10

HPFC

HARMONIC PHASE/FREQUENCY
COMPARATOR



HPFC TIMING

FIG. 11

Switched capacitor sampling of sine VCO at freq of REF, and stabilization via a 1-sample delay added in with coeff of typically 50%

Tank Capacitance pF	1
Drift on C, fC /REF period	(1.00)
VCO output range V	0
Transconductor G1 gain nA/V	0.02
... G2 gain relative to G1	50%
REF frequency, Hz	4000
VCO Center, mult of REF	250
VCO Gain, REFs/unit on C	20
Initial OUT Value	1.234
Held OUT Value	0.81
Held Frequency (x REF)	266.28

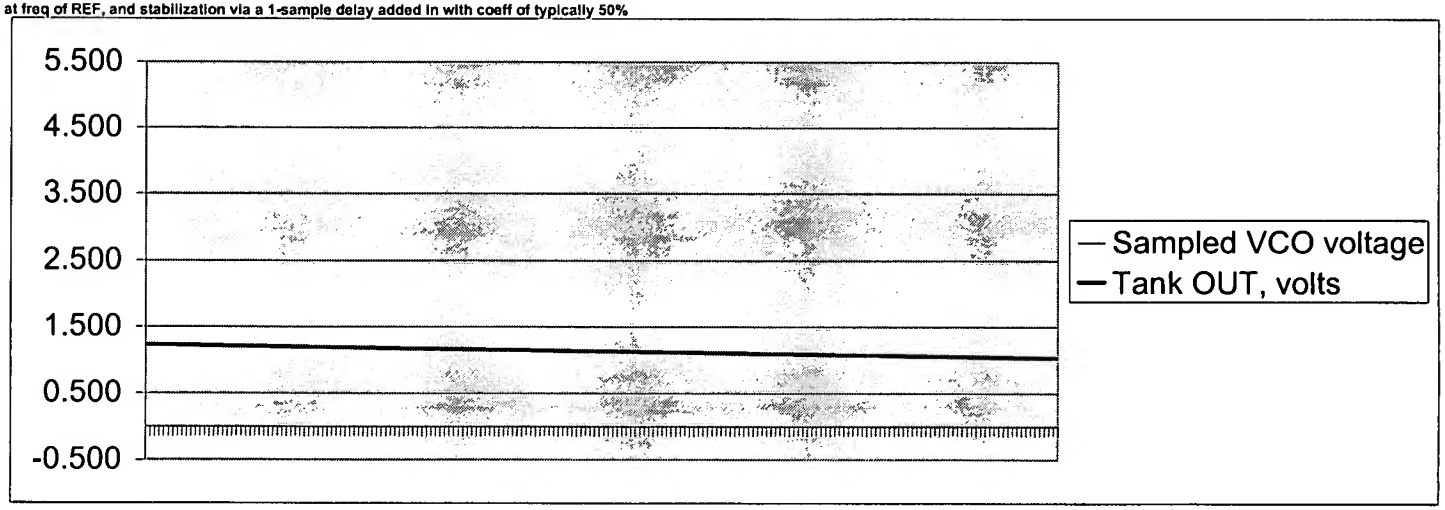


FIG. 12

Switched capacitor sampling of sine VCO at freq of REF, and stabilization via a 1-sample delay added in with coeff of typically 50%

Tank Capacitance pF	1
Drift on C, fC /REF period	(1.00)
VCO output range V	5
Transconductor G1 gain nA/V	0.02
... G2 gain relative to G1	50%
REF frequency, Hz	4000
VCO Center, mult of REF	250
VCO Gain, REFs/unit on C	20
Initial OUT Value	1.234
Held OUT Value	1.20
Held Frequency (x REF)	274.00

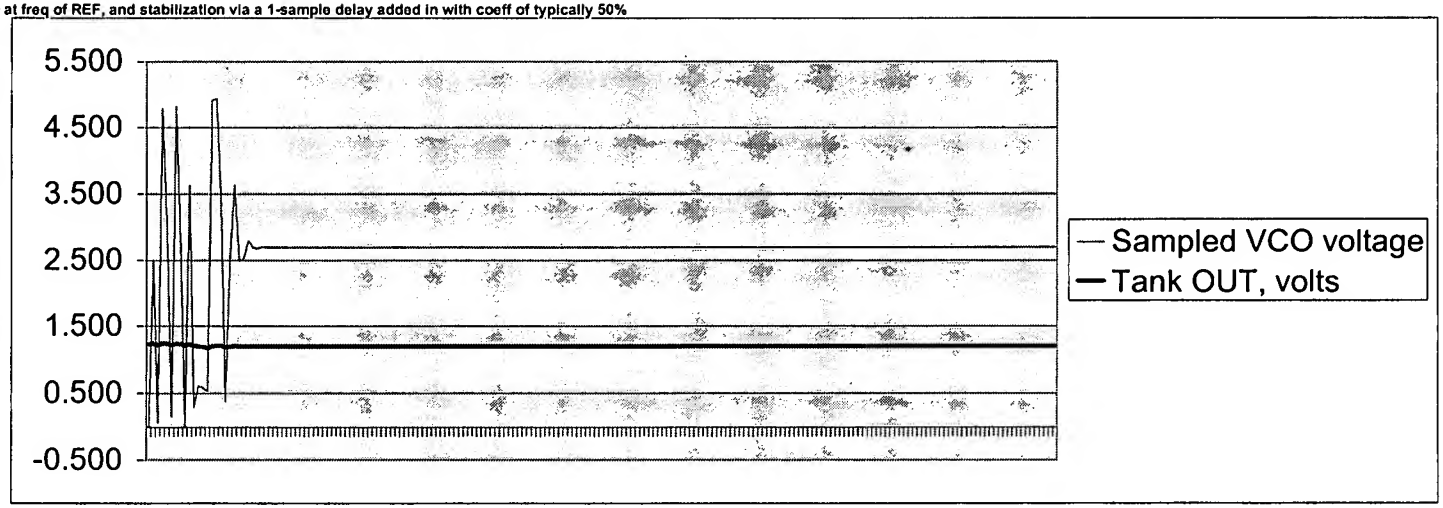


FIG. 13

Switched capacitor sampling of sine VCO at freq of REF, and stabilization via a 1-sample delay added in with coeff of typically 50%

Tank Capacitance pF	1
Drift on C, fC /REF period	(1.00)
VCO output range V	5
Transconductor G1 gain nA/V	0.02
... G2 gain relative to G1	50%
REF frequency, Hz	4000
VCO Center, mult of REF	250
VCO Gain, REFs/unit on C	20
Initial OUT Value	1.270
Held OUT Value	1.25
Held Frequency (x REF)	275.00

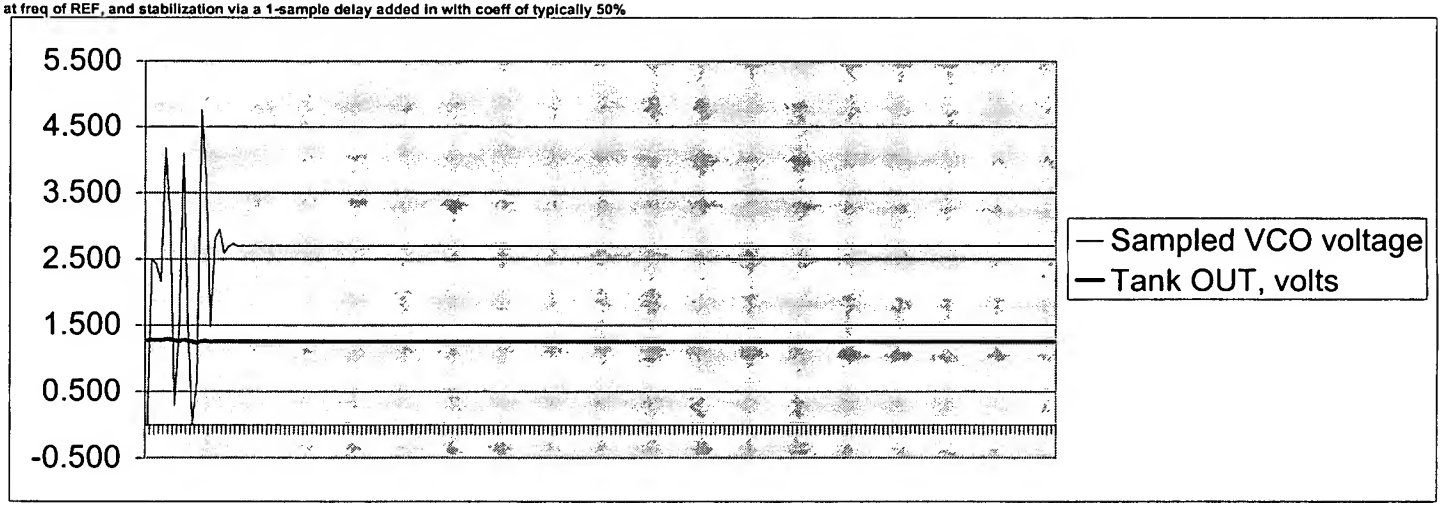


FIG. 14